Landslide Sites and Areas of Landslide Susceptibility

Town of Kittery, Maine

Landslide site mapping by:
Michael E. Foley

Landslide risk factor analysis by:
Michael E. Foley and Marc C. Loiselle

Digital cartography by:
Michael E. Foley
Susan S. Tolman

Robert G. Marvinney
State Geologist

Cartographic design and editing by:
Robert D. Tucker

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Maine Geological Survey
Address: 22 State House Station, Augusta, Maine 04333
Telephone: 207-287-2801 E-mail: mgs@maine.gov
Home page: http://www.maine.gov/doc/nrimc/nrimc.htm

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Landslide susceptibility in fine-grained sediments

Increasing susceptibility ↓

🟩	Slope less than 5 percent.
🟨	Slope equal to or greater than 5 percent.
🟧	Slope equal to or greater than 5 percent and one of the following terrain-related risk factors: slope aspect, curvature, or local relief.
🟥	Slope equal to or greater than 5 percent and two or three of the following terrain-related risk factors: slope aspect, curvature, or local relief.

Landslide susceptibility in other sediments

Increasing susceptibility ↓

▨	Slope less than 5 percent.
▨	Slope equal to or greater than 5 percent.

Terrain-Related Risk Factors

Slope: Slope is the primary driving force for landslides and earth movements. Slope is defined as the inclined surface of the land. The steeper the slope, the larger the shear stress produced by the weight of the materials and the more susceptible the slope is to failure. For this map, a slope of 5% or greater is considered a risk factor.

Slope aspect: Slope aspect is the direction toward which the surface of the soil faces. South-facing slopes undergo more extensive freeze/thaw cycles in winter months than slopes with other aspects. Repeated freeze-thaw cycles preferentially reduce the shear strength of the shallow soil material and increase the likelihood of shallow soil slumps. Ultimately, small movements may steepen the slope and lead to larger slope failures. For this map, a slope aspect facing between South 45º East and South 45º W is considered an additional risk factor.

Curvature (concave shape): Hill shape influences landslides by its effects on soil and water distribution. Concave surface topography will tend to concentrate the flow of surface water and ground water, raising ground-water pore pressures and reducing the shear strength of the soil. As a result, concave slopes are more susceptible to failure than straight slopes or convex slopes. For this map, a concave shape is considered an additional risk factor.

Local relief (slope height): As the thickness of the potential landslide block increases, the shear stress on the lower section of the block increases and the block (or slope) is more susceptible to failure. As a consequence, thicker sections of surficial materials will be more susceptible to failure and possibly deeper and larger failures. For this map, local relief greater than 6 meters (approximately 20 feet) is considered an additional risk factor.

Sites of past landslides

The purple area delineates the extent of the landslide and the letter indicates the type of landslide, defined in the diagram entitled *Common Types of Landslides in Maine.* Two or more letters indicate multiple processes were involved at the site or contributed to landslide morphology. Past landslides were mapped from aerial photo interpretation and field investigations in 2008.

Mapped landslides in the town of Kittery

This map can be used to identify areas with historical landslide activity and to identify areas that are susceptible to future landslide activity where additional studies should be undertaken before construction or other development is started that could be at risk due to a future landslide.

Seventy-one percent of mapped landslide sites in the town of Kittery (5 of 7 features) are located in areas shown as having a slope of 5 percent or more, and 86 percent of the mapped landslide sites are located in areas containing at least one additional geomorphic risk factor.

From this, we conclude that there is a significantly greater risk of a landslide occurring in areas containing one or more of the geomorphic risk factors than in areas that do not contain any of these risk factors.

However, no information is presently available to assess the probability of a landslide occurring within these areas. That is, if a landslide or earth movement does occur, it is very likely to be in the areas containing one or more of the geomorphic risk factors, but it is not possible at this time to predict whether a landslide or earth movement will occur.

Forty percent of the mapped landslide sites in York County are located in the glacial marine Presumpscot Formation which is known for thick sections dominated by marine clay. Eighty-one percent of the mapped landslides show at least some involvement with glacial marine deposits of all types, although other surficial materials (such as till or alluvium) may be present. Less than 14 percent of the mapped landslides involve Holocene alluvial deposits.

Sources of information used to make this map

Terrain-related risk were factors calculated from the National Elevation Dataset 1/3 Arc Second product developed and published by the U.S. Geological Survey. The horizontal resolution of the 1/3 Arc Second dataset is approximately 10 meters. Horizontal accuracy meets the National Map Accuracy Standard for a 1:24,000 scale dataset of ± 40 feet or 12 meters. Absolute vertical accuracy of the elevation data is ±7 meters or approximately ± 21 feet. The shaded relief layer was generated from this dataset, with a sun angle of 45 degrees above the horizon, azimuth of 315 degrees (northwest), and vertical exaggeration of 4.

The distribution of surficial geologic materials was compiled from the Maine Geological Survey surficial geologic maps listed at right. The following geologic units were considered to be "fine-grained sediments" for the purpose of this map: Pp, Pm, Pmd, Pmdo, Pmf, Pmn, Pmrs, Pms, and Ha. Where applicable, coastal landslide information was compiled from Maine Geological Survey coastal landslide hazards maps listed at right.

Clinch, J. M., O'Toole, P. B., Cameron, C. C., 1999, Surficial geology of the York Harbor quadrangle, Maine: Maine Geological Survey, Open-File Map 99-107.

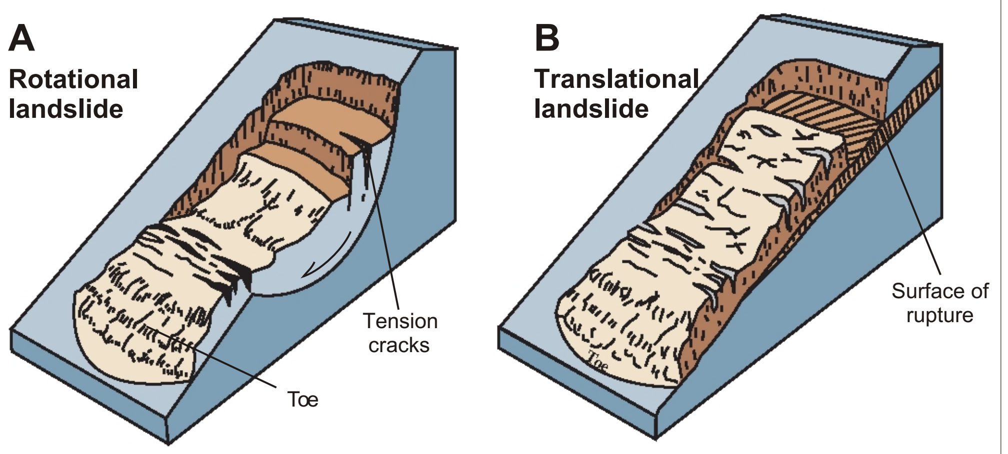
Dickson, S. M., 2001, Coastal landslide hazards in the Kittery quadrangle, Maine: Maine Geological Survey, Open-File Map 01-522.

O'Toole, P. B., Clinch, J. M., Cameron, C. C., 1999, Surficial geology of the Kittery quadrangle, Maine: Maine Geological Survey, Open-File Map 99-88.

Smith, G. W. and Cameron, C. C., 1999, Surficial geology of the Portsmouth quadrangle, Maine: Maine Geological Survey, Open-File Map 99-96.

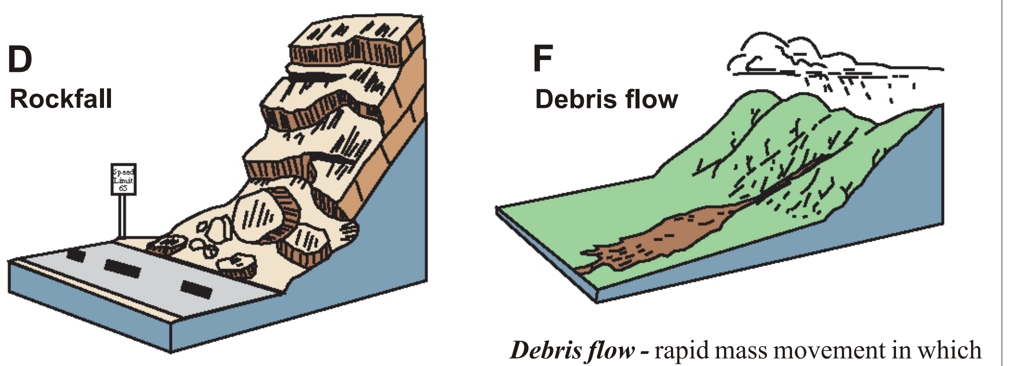
Smith, G. W. and Cameron, C. C., 2007, Surficial geology of the Dover East quadrangle, Maine: Maine Geological Survey, Open-File Map 07-80.

Common Types of Landslides in Maine



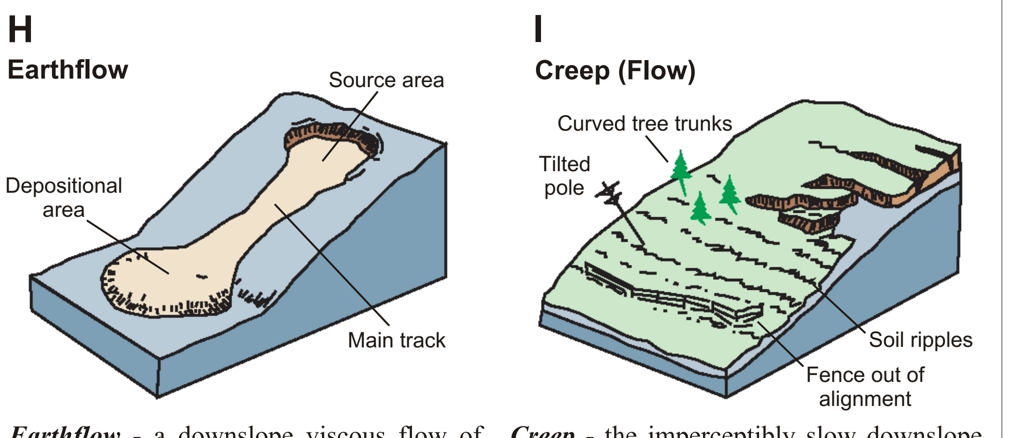
Rotational slide **-** the surface of rupture is curved concavely upward and the slide movement is roughly rotational.

Translational slide - the landslide mass moves along a roughly planar surface with little rotation or backward tilting.



Rockfall - abrupt movement of masses of materials, such as rocks and boulders, that become detached from steep slopes or cliffs.

Debris flow **-** rapid mass movement in which a combination of loose soil, rock, organic matter, air, and water mobilize as a slurry that flows downslope.



Earthflow - a downslope viscous flow of fine-grained materials that have been saturated with water and move under the pull of gravity.

Creep - the imperceptibly slow downslope movement of soil or rock caused by shear stress sufficient for permanent deformation, but too small to cause shear failure.

Diagrams and descriptions modified from Varnes (1978), U.S.Geological Survey Fact Sheet 2004-3072.

Limitations of the data

This map may be used to identify areas that are susceptible to landslide activity. Based on the risk factor analysis, ***if*** a landslide or earth movement does occur, it is very likely to be in the areas containing one or more of the geomorphic risk factors shown on this map, but it is not possible at this time to predict ***whether*** a landslide or earth movement will occur.

The landslide site mapping and risk factor analysis were done in 2008. Some mapped landslides may have occurred since the photography and digital elevation model were mapped or generated.

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